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Design aspects of High Temperature Superconducting (HTS) Synchronous Motors - A Review

Content :

High Temperature Superconducting (HTS) synchronous motors consist of HTS windings in the rotor and air gap copper windings in the stator. This technology will help in manufacturing compact, lighter motors with a high torque to weight ratio, low noise and better dynamic response needed for strategic applications. The design of such HTS synchronous motors involves Electromagnetic, Mechanical and Thermal (cryogenic) aspects. Electromagnetic design includes selection criteria of HTS wires, sequence of HTS rotor coil winding, stator dimensions, stator air gap copper winding and slot details etc. Mechanical design confirms the dimensions of the rotor shaft, stator frame, bearing details, coil-holding arrangement, rotary feed-through etc. Thermal design reveals the required cryo-cooler capacity, material selection for different rotor components, selection of cryogen, vacuum level requirement, torque tube performance, cryo-cooling arrangement etc. In this paper, the various components of a HTS synchronous motor along with their design aspects (electromagnetic, mechanical and thermal) are presented. These studies are useful for design and development of a reliable, compact and economical HTS motor.

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